SUMMARY REPORT
August 2017

Bushfires and Biodiversity:

Optimising conservation outcomes in peri-urban areas at risk



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Summary

Summary

This report is part of the Australian Research Council Project, “Bushfires and Biodiversity: Optimising conservation outcomes in peri-urban areas at risk” (LP130100406).

A total of 988 households responded to a postal questionnaire survey, providing information about their experiences, values and preferences related to bushfires and biodiversity impacts they had observed. Some 505 additional participants also provided feedback via focus groups, follow-up surveys and interviews.

Objectives and Methodology

The key objectives were to:

- identify perceptions of local residents regarding both the growing risk of bushfires and the need to conserve biodiversity in peri-urban areas;
- develop understandings of the relationships between perceived vulnerability to bushfire risks and people’s demographic and geographical situations, as well as their level of knowledge of fire, conservation management and biodiversity;
- critically examine planning and policy goals in relation to bushfire and biodiversity conservation, identifying successes and limitations to determine best practice and pitfalls; and
- recommend directions for future planning and policy, by developing a response framework to best retain environmental value and mitigate risk for peri-urban spaces.

Through responses to questionnaires, focus group discussions and one-on-one interviews, the project explores a series of questions regarding residents’ attitudes and current public policy, and the intersection between the two:

- How might communities better utilise scientific knowledge around fire risk and conserving biodiversity?
- How might policy-makers implement policy goals to change public behaviour in relation to native vegetation management in order to maximise public safety in the event of a bushfire?
- How do attitudes, norms and values surrounding issues of biodiversity affect the responses that individuals living in fire-prone areas make when confronted with extreme fire danger?
- To what extent are these attitudes and priorities taken into active consideration by policy-makers and current environmental governance structures?
- Can distinct societal groups be identified in terms of their risk and value perceptions? How might policy be developed to support these groups in understanding and enacting effective management outcomes?





Key Results

Planning

- Modern planning processes have not responded well to the complexity of situations in the peri-urban fringe. Limitations are becoming increasingly apparent.
- It is increasingly difficult for state or private actors to insulate people and assets from bushfire risk.
- The pendulum of cultural interpretations of risk and value could swing widely in the future (e.g. driven by responses to climate change) to the detriment of environmental assets.
- Current planning legislation does not sufficiently accommodate the growing risk of bushfire in relation to the placing and shaping of new urban/suburban developments.
- Media headlines that many people think controlled burning is 'bad' are over-stated. The data in fact suggest strong support for prescribed burning.
- A balanced approach to risk mitigation and biodiversity protection is possible. Evidence suggests residents have high regard for the biodiversity values of their regions.
- For some residents of the peri-urban fringe, issues of evacuation as a result of transport infrastructure may be a major risk if there is a bushfire.
- The planning system needs to attain a better balance between the influence of specialist planners, the community, major actors (e.g. business) and elected representatives.

Biodiversity values

- Residents are largely open to a sophisticated ecological debate regarding the challenges of maintaining biodiversity in the face of a growing risk of bushfires. The debate should consider all stakeholders and their various priorities.
- Cultural nuances of acknowledgement of risk and prioritisation of biodiversity values need to be integrated into management.
- There are clear differences between men and women in their ecological values, fire-risk assessment, preparation and response. Current bushfire planning outreach insufficiently acknowledges these differences, emphasising physical rather than emotional preparedness.
- Few significant differences were found between residents' perceptions of risk and perceptions of management before and after the Sampson Flat bushfire.

Climate change

- There is a sceptical group of residents who do not recognise the link between climate change and bushfire risk, but they are supportive of direct management interventions to reduce bushfire risk with prescribed burns and clearance of native vegetation.
- Unless targeted communication strategies assist people to recognise the need for balanced management both to mitigate bushfire risk and conserve biodiversity, thresholds of risk perceptions may be exceeded that in turn lead to hazard mitigation policies discounting environmental values.
- There was no significant relationship between recognition of the risk of climate change and the perceived likelihood of bushfire within short timeframes (1 or 5 years).
- Three distinct groups of residents were recognised in terms of attitudes to climate change and associated attitudes to bushfire risk; an Action Group, an Action Gap Group, and a Sceptical Group.
- People who recognise climate change and its influence over bushfire risk are less likely to support vegetation management that undermines local ecological values.

- Almost two-thirds of respondents already support a range of management outcomes that aim to strike a balance between bushfire risk mitigation and biodiversity conservation.
- Residents' environmental values are a better predictor of their behaviour with respect to climate change mitigation, than are knowledge or beliefs about climate change.

Preparedness and readiness

- Despite advances in individual landholder preparedness for bushfires, overall community readiness appears to be lagging and needs more attention.
- The creation of fire-smart communities relies not only on engaged individuals but also a pervasive sense of shared ownership of the challenge of living in a high-risk bushfire zone.
- Preparedness efforts for bushfires largely rely on the impetus from those outside the community rather than the residents using their own initiative and energy. This restricts the impact of many attempts to better educate residents about bushfire risk and desirable actions to take.
- There is a knowledge gap concerning perceptions of biodiversity conservation in a fire management context.
- Plans for the future growth of Adelaide have paid insufficient attention to future conflict between safety of residents in the event of a bushfire and protection of both biodiversity and valuable landscapes.





Introduction

Introduction

This project explores perceptions of vegetation management regimes in peri-urban areas of the Mediterranean biome in South Australia facing high bushfire risk. It addresses and seeks to balance two concerns:

1) the threat of destructive bushfires occurring close to residential areas; and
2) the need for effective conservation measures to maintain important and unique biodiversity.

The aim is to determine stakeholders' understanding of vegetation risks and values and what motivates the decisions of managers, communities, individuals and other key stakeholders when faced with a significant threat of bushfires in areas of high biodiversity value.

Approach

The research focused on the Adelaide and Mount Lofty Ranges (AMLR) and Lower Eyre Peninsula (LEP). Both of these experience a Mediterranean climatic regime of hot summers and cool winters that render large areas susceptible to bushfires. They were selected because they both have widespread peri-urban growth that includes important national and conservation parks, and high risk of bushfires, although they have experienced different bushfire histories and fire frequencies.

In late 2014, a postal survey was delivered to some 3300 households of the AMLR and LEP to help us examine community understanding of bushfire risk and the need for conservation measures. In total, almost 1000 surveys were completed, representing a satisfactory 30% response rate. There were 191 completed from the LEP study site and 797 from the AMLR study site (Figure 1).

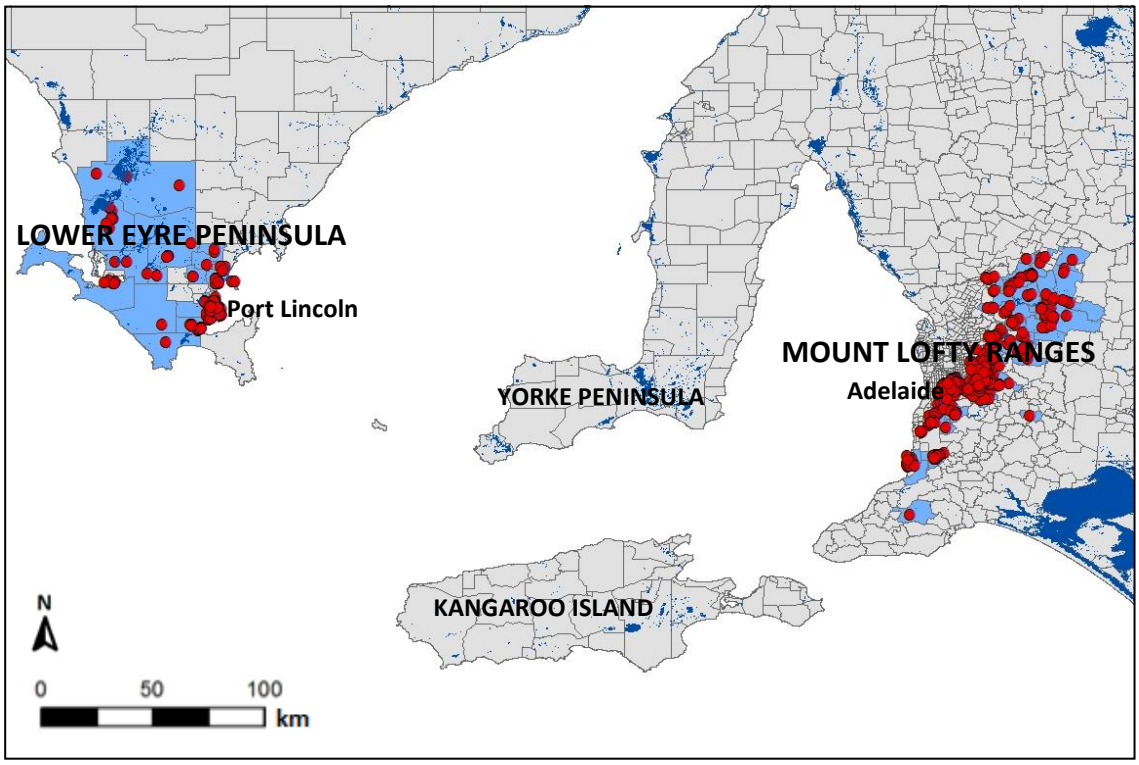


Figure 1: Map showing study areas (medium blue) and residential location of participants (red dots)

In addition to the postal survey, a series of focus group meetings (n=14) were conducted with the following:

- The Department of Environment, Water and Natural Resources (DEWNR):
    - Flood and Fire Management Unit
    - Conservation Biodiversity Unit
- DEWNR and Natural Resources Management regional staff (e.g. Ecologists, Senior Rangers, District Officers) from the LEP and the Central, Southern and Northern AMLR Districts (at four separate workshops)
- The AMLR Bushfire Management Committee
- The SA Country Fire Service (CFS)
    - Adelaide-based staff (e.g. Prevention Officers, policy-makers, managers)
    - State-wide Community Engagement Officers
- Environmental groups (e.g. non-profits and volunteer groups such as Friends of Parks)
- Planning authorities (e.g. Department of Planning, Transport and Infrastructure, local government planners, planning consultants)
- Community members (LEP & 2 x AMLR)

One-on-one interviews were also conducted with authorities from some local government areas in SA (e.g. Fire Prevention Officers, Development Managers, Planners, Biodiversity/Environmental Officers), and with 20 local landholders in the LEP study site. Each of these activities allowed researchers to understand the key issues as perceived by these key stakeholder groups and have proved invaluable for identifying target areas of concern within the study sites.

My children want me to leave because it's not safe now my hubby has gone and I'm old. But I just can't. I love it here. I love the birds and the trees. If it ends up I burn to a crisp, so be it.

I think we all enjoy the wildlife and we all enjoy having it there, and I want to have the little birds and encourage them in. So, that side of me wants to have the bushes and things that they can live in and be protected in, then the other part wants to be safe.

We were totally unprepared; never thought about it, never thought about it at all. But we could see [the fire] was coming. And then we decided, yes, it was coming to us. So, we came in, got the dogs, shut the place up and went to change, because we had sleeveless shirts and short shorts and knew that wasn't any good. So, while we were changing, the fire front arrived. It went over, it took five minutes. It was pitch black the entire time, you couldn't see a thing. I got my jeans out of the bottom drawer, and I got the wrong ones … which were much too big around the middle. And all the time I was fighting the fire … pulling these things up. Anyway, once the fire front went over, we went out and started putting out the embers that were around.

I like the fact that there's greenery all the way 'round and I like the fact that there's – there are birds … it's very, very peaceful. And I've got views of the city and views of Mt Barker so I just live in the most beautiful place in the whole world and I'm much too old to go on living there by myself, but I won't move.

I believe there are some plants that are locally native that would be great for encouraging native animals and insects and stuff like that, and helping that ecosystem keep going, but which will not go "whoosh" as much as some of the other plants do, as I mentioned, the "Kerosene Bush". One of my jobs is actually to cut back my bay tree because I tested that, and that one goes up "whoosh" as well.

If we keep going [with] the population increase across the Adelaide Hills … there's not going to be a skerrick of natural bush left other than in those protected areas which conservation parks are… proclaimed areas that you can't build on.

You talk to two groups of people – one hates fire because it's bad for biodiversity, and the other group hates trees because they're bad for fire risk.


Trees For Life
Bush For Life
Site
Volunteers Caring For Bushland
Trained volunteers are protecting valuable native vegetation
This Program Is Assisted By:

Results

Snapshot of Data from the Postal Survey

Participant profile (N = 988)

Adelaide Mount Lofty

- N = 797
- 55% male
- 63% aged 35-64 years
- 30% aged 65+ years
- 50% households with children
- 68% with tertiary education
- 12% work in health care, 11% in education, & 11% in professions/science/technical
- 27% earn > $120,000 pre-tax
- 95% own their property
- Average age of house: 43 years
- Mean length of residency: 20 years
- 44% previously lived in city
- 80% knew their current insurance company covered their house & property in event of a bushfire (18% unsure)
- 60% consider the land use where they live to be urban (40% rural)
- House on larger sized block (2-5ha): 18%
- House on small acreage (6-10ha): 10%
- House on large acreage (>10ha): 7%
- Native vegetation on property:
  Mean: 23% cover
- 67% live immediately adjacent to vegetation
- Dominant type of vegetation closest to property: 43% shrub
- 38% of adjacent vegetation has protected status
- 39% believe adjacent vegetation has burnt
- 12% are CFS members
  (or have CFS member in household)
- Average length of experience with CFS:
  15 years
- 9% (n=75) have had a house or property damaged by a bushfire
- Of those: 40% in 1983
  16% in 1980
  4% in 2009

Lower Eyre Peninsula

- N = 191
- 60% male
- 65% aged 35-64 years
- 27% aged 65+ years
- 42% households with children
- 36% with tertiary education
- 19% work in the agriculture, forestry & fishing industry & 10% in health care
- 16% earn > $120,000 pre-tax
- 94% own their property
- Average age of house: 31 years
- Mean length of residency: 25 years
- 16% previously lived in city
- 83% knew their current insurance company covered their house & property in event of a bushfire (14% unsure)
- 55% consider the land use where they live to be urban (45% rural)
- House on larger sized block (2-5ha): 17%
- House on small acreage (6-10ha): 7%
- House on large acreage (>10ha): 11%
- Native vegetation on property:
  Mean: 17% cover
- 68% live immediately adjacent to vegetation
- Dominant type of vegetation closest to property: 63% shrub
- 16% of adjacent vegetation has protected status
- 57% believe adjacent vegetation has burnt
- 22% are CFS members
  (or have CFS member in household)
- Average length of experience with CFS:
  17 years
- 31% (n=60) have had a house or property damaged by a bushfire
- Of those: 44% in 2005
  31% in 2009
  16% in 2001

Introduction to Results

The results from the postal survey were analysed to identify major trends in perceptions. Respondents were concerned about the likelihood of bushfires and their vulnerability to them.

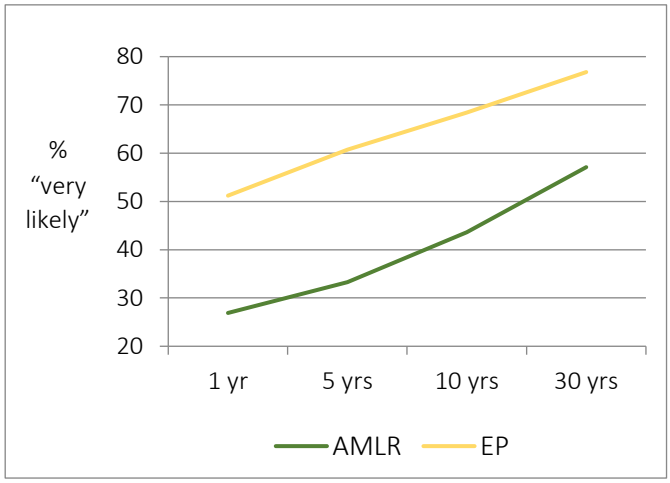


Figure 2: Perceptions related to the likelihood of a bushfire.

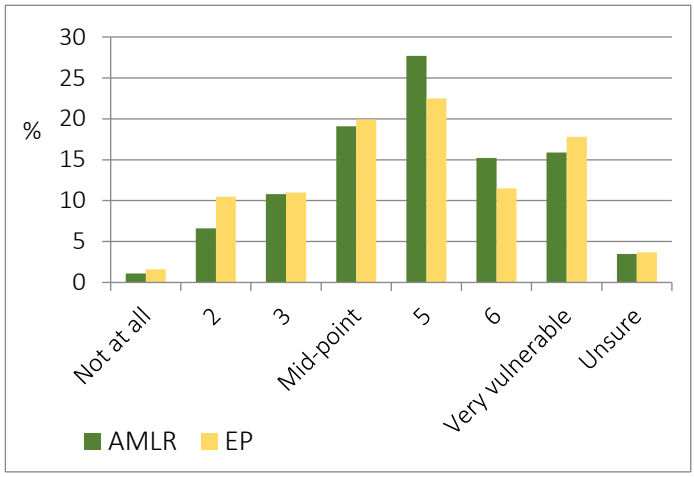


Figure 3: Perceptions of property vulnerability in bushfire.

Local government was regarded as the most important governance level for both the reduction of bushfire risk and the conservation of local biodiversity.

Table 1: Entity perceived by respondents as most effective for making decisions.

Entity	Reducing bushfire risk (%)	Conserving local biodiversity (%)
Local government	50	42
State government	20	17
Federal government	3	3
Community or non-profit group	14	25
Don't know	5	8
Other	8	4

In general, respondents held relatively positive perspectives on current environmental management:

- 39.5% strongly agreed regular prescribed burning is a good idea (a further 43.8% had positive views)
- 31.9% strongly agreed prescribed burns close to their homes were acceptable (a further 49.4% agreed)
- 33% strongly agreed some discomfort arising from prescribed burns is acceptable (a further 52.3% agreed somewhat)
- 34.5% strongly agreed vegetation clearance to reduce risk is effective (a further 49.2% agreed)
- 39.4% believed they should have a say on vegetation management in neighbouring properties (of these 9.4% strongly agreed)
- Only 8.8% of people felt current attention to bushfire risk is excessive

High levels of trust were recorded for both CFS and DEWNR.

***Table 2:** Levels of trust in key organisations (1 = low and 7 = high).*

	CFS	DEWNR
Staff level	5.61	4.74
Organisational level	5.29	4.10

***Table 3:** Aspects of trust receiving highest and lowest ratings of trust.*

	Highest	Lowest
CFS	Staff are well trained (M=6.11)	Citizens have a voice in their projects (M=4.98)
DEWNR	Staff are knowledgeable about technical matters (M=5.33)	Citizens have a voice in their projects (M=3.66)

Bushfire risk management was rated higher than vegetation management in general.

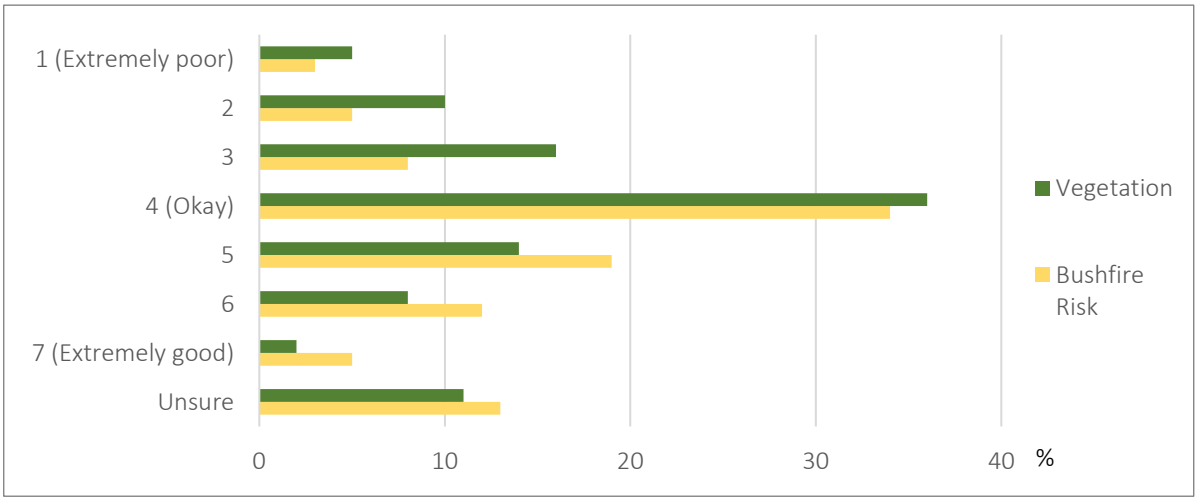


Figure 4: Ratings of current management in respondents' local area.

Respondents varied in their opinions of how influential they can be over environmental management.

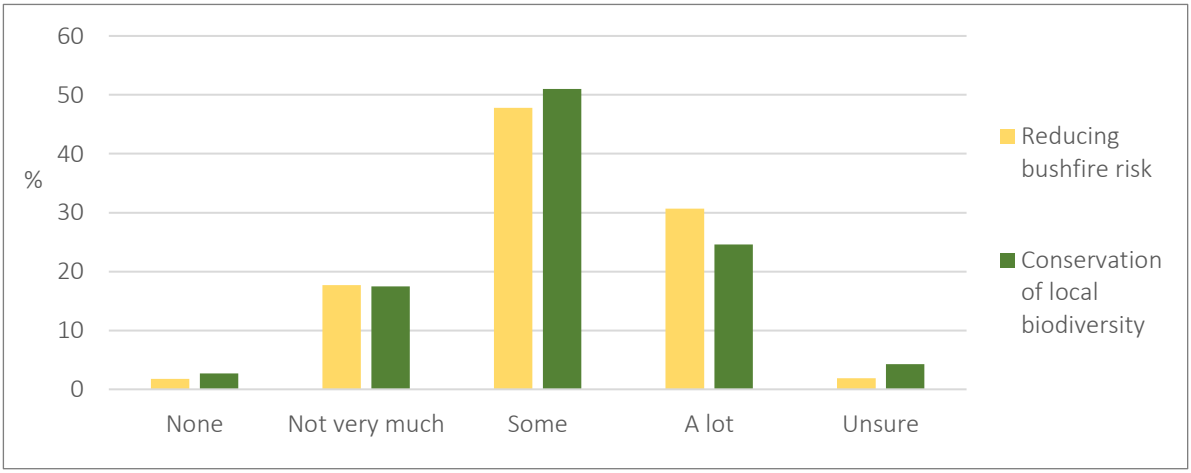


Figure 5: Perception of influence by residents.

Respondents are undertaking a range of actions to mitigate the bushfire risk, most of which would have limited impacts on levels of biodiversity.

***Table 4: Bushfire mitigation** actions undertaken by respondents.*

Treatment / Action	Yes (%)
Clear leaves, twigs and long grass immediately adjacent to the house	89
Clear the gutters of leaves	85
Clear leaves, twigs and long grass for a distance of about 20m around the house	77
Water frequently during the bushfire season	75
Developed a Bushfire Survival Plan (BSP) / Bushfire Action Plan (BAP)	68
Obtained a battery-powered radio	66
Obtained and prepared equipment such as ladder, buckets and mops to put out spot fires	62
Move combustible materials such as firewood and wooden garden furniture away from the house	61
Regularly updated all household members on the Bushfire Survival Plan	56
Remove large trees within 20m of the house	34
Remove large trees within 40m of the house	15

Respondents source their information from a range of sources, but radio is still the most important.

Table 5: Communication channels most frequently used (rated as top three channels).

Source	Biodiversity %)	Bushfires (%)
News radio	49	51
Read the newspaper	30	25
Internet	25	40
Talk to friends	22	14
Neighbours	16	15
Scientific reports	16	5
NRM office / newsletters	13	1
Local Messenger / Courier	12	12
Councils	12	14
Public meetings	11	19
Talk to family	10	8
CFS (general)	7	38

The majority of respondents considered biodiversity to be important (60%) or somewhat important (29%) when determining bushfire prevention policy.

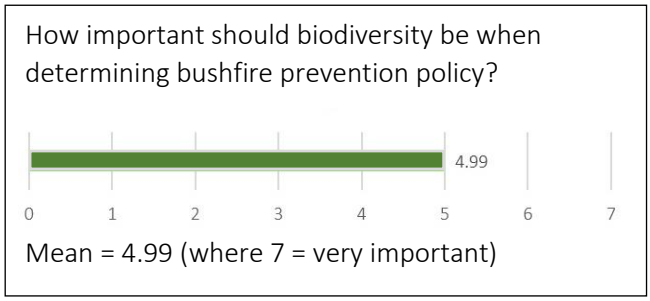


Figure 6: Mean rating of importance of biodiversity when determining bushfire prevention policy.



Discussion

Key Focus Areas of Discussion

This section presents an overview of the principal areas explored through more targeted data analysis, as identified by the researchers in conjunction with project partners as significant areas of interest.

Planning

Peri-urban planning in the Mount Lofty Ranges [1]

The emerging governance challenge to simultaneously mitigate bushfire risk and support improved conservation practices was reviewed in the context of precolonial and modern cultures within the peri-urban Mediterranean climatic region of South Australia's AMLR. The analysis suggested that anthropogenic burning of landscape has been a vital historical component of risk management. During the early modern era however, improved capacities to manage bushfire risk led to complacency with respect to the hazard, which in turn has led to urbanisation that has accounted insufficiently for the levels of risk. A planning conflict is emerging within the wooded uplands as there is renewed interest in bushfire risk, which is reflected in new state policies providing greater allowances for landowners to clear vegetation around dwellings.

Although attempts have been made to constrain urban growth around the city of Adelaide, our workshops with key environmental management stakeholders suggest that urbanisation continues within the AMLR in areas that are both highly vulnerable to fire and of great importance for biodiversity conservation, such that planning is not reflecting the cultures of risk or biodiversity value. For these risks and values to be considered within reflexive systems of governance, the narratives on opportunities for adaptation generated by the people who facilitate vegetation management must be accommodated into deliberations on policy. The identification and planning of particularly vulnerable and valuable spaces within the broader landscape and cultural contexts of risk and value would enable complex, targeted responses to environmental hazards, conservation and development needs in the peri-urban uplands.

- The tension between the cultural forces of attraction and repulsion to different landscapes strongly influences how the AMLR have been managed in the past and will be managed in the future, but modern planning processes have not responded to that complexity.
- It is increasingly difficult for state or private actors to insulate people and assets from bushfire risk within upland areas on the peri-urban fringe, and that is leading to some perverse policy outcomes.
- While recent changes to policy may have had little impact on conservation outcomes in the AMLR as the cultures of attraction dominate, if the balance in perceptions between the value and risk of native vegetation changes, for example as climate changes and impacts of bushfires increase, the modern governance limitations may become evident.
- From the perspective of the designated native vegetation managers, the legislation currently leaves too much flexibility for the pendulum of cultural interpretations of risk and value to swing widely to the detriment of environmental assets.

- A gap has also been identified in the planning legislation, which does not sufficiently accommodate the new risk of bushfire in relation to the placing and shaping of new urban developments. The contemporary managers of peri-urban vegetation are not able to strongly influence planning outcomes, and are therefore unable to reflect the complex dynamics that are unique to this space. In fact, their current understandings of risk and value do not enter planning deliberations unless informal relationships are well established, and that necessarily limits the validity of plans, both systemically and spatially.
- The learning by expert practitioners can guide policy and practice in a reflexive manner. Strong forms of engagement, including regular interviews or deliberative workshops, enable an effective process of re-assessment of policy settings – articulating conflicts and promoting narratives on risk to help inform sophisticated planning.

Generating narratives to inform environmental policy [2]

Workshops and interviews with vegetation specialists and bushfire managers were undertaken to facilitate deliberation on planning opportunities for the peri-urban areas around Adelaide and Port Lincoln. The stories of local bushfires and biodiversity from people with a diverse range of expertise in bushfire, land and vegetation management inform narratives on risk and value, which in turn enable deep and contextual understanding of the complex management challenges. Important mutual learning was developed by applying social learning techniques that associated expert experiences with scientific information to generate comprehensive, contemporary perspectives on risk and value to guide environmental policy.

- The development of narratives on risk allows for the expression of ideas that might otherwise remain unspoken in a formal planning context. Key themes derived from workshops are presented in Table 6.
- The first narrative of 'The public think all fire is bad' is of special interest not only because prescribed burns represent an important vegetation management tool being used to manage bushfires in the region, but also because it may be a misconception that needs to be addressed by fire managers, noting the postal survey data reveal very high levels of acceptance of prescribed burns as a fire management tool among SA's peri-urban residents.
- Several narratives emerged in this area, with some experts referring to people who recognised the value of fire but an overwhelming perception was that a large group within the public is concerned about both prescribed fires and bushfires. It is possible that experts' opinions are influenced by media reports that highlight community outrage at prescribed burns that subsequently had led to bushfires, and the reality of public opinion is more favourable.

Table 6: Key Narratives and Examples.

Key theme	Example of narrative
Community perceptions of fire and biodiversity	The public think all fire is bad. *'One of the things I notice most of all is the public perception about prescribed burning and its value for risk mitigation and for biodiversity. Some people are so frightened of fire that any fire is just really, really bad…people are going to be too frightened to let us mitigate risk.'* The public don't behave in a way that reflects "shared responsibility" in the sense we intend it. *'What I'd like to see … is actually for people, the peri-urban community or individuals to understand they've got an active role in management of bushfire risk. Where … they're just not receiving the information, they're actually also owning it and acting on it.'* The public don't care about biodiversity in the same way we do. *'I don't get a sense, necessarily, that people care about biodiversity in the Hills per se. I think they care about trees and the kangaroos, and they care about the amenity, but I don't think they really care about biodiversity per se…. I think people have a sense about the government will look after their risk, and protect them from fire. So that's how I interpret why people do or don't clear [vegetation].'*
Improved education and community engagement	A balanced approach to risk mitigation and biodiversity protection is possible. *'If we can fine tune some of the CFS policy-driven messages that are getting out there, for example fuel reduction doesn't have to be ground zero with herbicide, it can be substituting native grasses for other grasses… those sorts of things, give people solutions not blanket prescriptions that are really drastic… we can fine tune the message and get a better outcome both for fuel reduction and biodiversity and hopefully for safety.'* Communicating risk is inherently difficult. *'How do you communicate something that's actually quite intangible anyway?'*
Improved planning across multiple agencies and whole landscapes	The most strategic way forward for fire mitigation is a tenure blind approach. *'We do all our mitigation work on public lands largely and where those public lands are continuous there is a good level of strategy for fuel reduction zones, but obviously a lot of it particularly across the Mount Lofty Ranges is very fragmented and…, and really doesn't provide that broader landscape scale fuel reduction to… try and minimise that bushfire risk. And it's quite clear that there are opportunities to do that if everyone was looking at the whole of tenure… I know our organisation is very, very supportive of it. CFS are thinking that way; it's just a mechanism to ensure that the planning is done – so there's good bushfire threat or risk analysis undertaken, really understanding where our high risks are and having good broad scale treatments to try and mitigate against those larger, larger risks.'* Legislation needs to reflect the inter-dependent reality of fire management. *'Often we won't know about a development until someone's submitted an application to Council so it would be good if the development is going to abut a park that the developer has to engage us in the process prior to that. [Some Councils] are really good; they will say to their developers we're not even going to consider your application until you've spoken to DEWNR because we're not going to approve something that they're not going to support, … There are planning development issues but there's no legislative requirement for us to be involved in any of that planning.'*

Planning for environmental hazards in peri-urban South Australia and Ticino, Switzerland [3a-c]

Annette Bardsley, PhD Candidate (University of Adelaide)

Peri-urban areas are dynamic spaces. As cities expand, conflicts of interest arise along with the transition to urban land uses. In both South Australia and Ticino, Switzerland peri-urban areas are often associated with high amenity and biodiversity values, whilst also being characterised by high risks of environmental hazards such as bushfires. At the same time, South Australia is implementing a new planning bill that aims to be more inclusive of community opinion, while Switzerland has a highly developed deliberative planning system that has attempted to incorporate citizens' voices directly into the heart of spatial planning decisions.

Householder surveys were conducted in 2015 in the Mitcham and Onkaparinga Council areas in South Australia, and adjacent to the city of Locarno in Ticino, Switzerland. Residents living in close proximity to important conservation areas in both locales were asked to provide their perceptions of environmental hazards, risks, place values and satisfaction with vegetation management and land-use planning. Key elements of the questionnaires enquired about residents' involvement with current planning. The differences of opinions were analysed in relation to Australia's representative and Switzerland's deliberative political structures. The analysis established whether political structure influences residents' sense of agency and their willingness to participate in planning decisions.

Several important results are emerging:

- One significant finding is that due to inadequate vehicle egress opportunities residents living in high fire-risk areas in close proximity to Sturt Gorge Recreation Park, whilst accepting of the risks associated with living in forested suburbs and supportive of current levels of vegetation management, feel considerable evacuation vulnerability in the case of a bushfire. They are concerned that with a growing population, planning has not sufficiently considered issues of transport access.
- The Swiss deliberative approach to planning provides altogether more opportunities for citizens' voices to influence decision-making, but it is not clear that surveyed community members feel that planning responds to their concerns.
- These findings from both study areas suggest that decisions directly affecting daily lives and vulnerability levels in relation to environmental hazards require a deliberation process that allows not only for the expression of local voices in relation to risk and value, but also subsequent actions that reflect these views.
- This conclusion is important just at a time when South Australia is reforming its planning system to strike a balance between the influence of specialist planners, the community and elected representatives' decision-making.

Biodiversity values

Recognising ecological sophistication to manage risk while retaining biodiversity values [4]

Our results suggest residents have a strong appreciation of both biodiversity and prescribed fire when deliberating on conservation and mitigation of bushfire risk. Residents seem to be open to a more sophisticated ecological debate on this topic than decision-makers realise, and would welcome communication that informs and engages while presenting the alternatives within local contexts. It is proposed that peri-urban residents are indeed well placed to appreciate the need for a more sophisticated policy approach that considers all stakeholders and varying priorities.

- LEP residents were significantly more likely to acknowledge a bushfire was very likely to occur within five years (M=6.21, SD=1.27) compared with MLR residents (M=5.51, SD=1.44, t(296.77) = 6.47, p=.000). This was despite more MLR respondents living in areas classified as 'high' risk than LEP respondents (where more respondents lived in 'medium' risk areas). This result may reflect the different fire histories of the two areas.
- It was also the respondents who had lived in their locality for 20 years or more who were more likely to think a bushfire might occur in the next five years (M=5.77, SD=1.47) compared with those who had lived there for fewer than 20 years (M=5.55, SD=1.4, t(917) = -2.34.3, p=.02).
- 61% of respondents claimed biodiversity and conservation values to be important in choosing to live where they do, 20% expressed neutrality, with only 19% saying it was not important. AMLR respondents were more likely to value their 'leafy neighbourhood' but less likely to prioritise 'recreational pursuits' than LEP respondents.
- 63% of respondents would like to see more native vegetation where they live (with only 12% indicating they would like to see less of it). Almost three-quarters (73%) stated they would prefer to see greater protection from urban development (with 13% disagreeing). This was also evident in the interviews and focus group discussions, with residents demonstrating support for restricted urban growth:

  > *The good thing about the town [Port Lincoln] is it can only get to a certain size because national parks are on two sides and water on the other. So, it can't do anything more than that.*

- Having an 'environment free of weeds' was highly valued, with 43% of respondents considering weed-free vegetation to be 'very important' where they live, and a further 40% considering it 'important'.
- There was reasonably high support for prescribed burning and vegetation clearance close to homes as well as in conservation areas, with a moderate positive correlation between perceptions of the effectiveness of the two different approaches (r(893) = .53, p=.000) suggesting people who support one regime also tend to support the other.
- The findings suggest that living successfully with bushfire under changing demographic, development and environmental conditions will require a new level of ecological sophistication. Residents weigh up biodiversity conservation values against bushfire risk mitigation activities in specific and complex ways. The cultural nuances of acknowledgement of risk and prioritisation of biodiversity values need to be integrated into management.

Gender matters [5]

Men and women differ in fire-risk assessment, preparation and response. Conventional bushfire management maintains traditional gender roles, norms and power dynamics in overt and covert ways. Current bushfire planning outreach emphasises physical preparedness while emotional preparedness receives far less attention.

- Females reported ecological values as more important in helping to choose to live where they do (M=4.93, SD=1.72) than males (M=4.63, SD=1.75, t(858) = 1.4, p=.012).
- Females expressed higher support for vegetation management to maximise native biodiversity, protect native wildlife, and increase shade.
- Females reported having less knowledge about and training in bushfire management.
- While only 39% of all respondents thought a bushfire was very likely to occur within the next five years, 61% thought one was very likely within the next 30 years. On average, females (M=5.75, SD=1.39) were more likely to acknowledge the risk of bushfire occurring where they live within the next five years than men (M=5.56, SD=1.46, t(914) = -1.98, p=.04).
- Females (M=5.01, SD=1.53) considered their property to be more vulnerable than did males (M=4.6, SD=1.5, t(934) = -4.14, p=.000).
- Bushfire survival planning is an emotional process with lots of uncertainties:

  I think for me my worries are yeah, we live in a very old [house] … and we've got a very comprehensive bushfire plan. We would actually stay. But it's yeah, you know, I still of course worry an awful lot. You know, scenarios: whether I'm on my own [or] with my daughter or with my older sons, or my husband's there, there's always what if. If he's there with me or not. And, I've got two dogs and we have nowhere to go. We don't know really where to go.
- A longer-term view of biodiversity:

  When you're rebuilding after being burnt out, you're not looking just for the next 5 years, you're looking for the rest of your natural life in that house. And so women tend to have a longer range in planning than men. It would be nice to actually see a few more women in those decision-making roles about things like burn-offs and making sure that after a fire the biodiversity is actually looked after rather than just left.
- Highlighting the dilemma of their love of natural environments but associated concern of bushfire, one female LEP interviewee said:

  I can't say that I'm very happy during summer when we have bushfire days. I'm not as bad now as I used to be, but it still makes me quite nervous. The Coomunga Fire actually had me seriously thinking about moving, if not into town then over to Adelaide … I do love the Eyre Peninsula, it's just I don't love bushfires as much … but I do love having the natural environment around me.

Perceptions of management and experience with bushfire [6]

Asthe Sampson Flat fire occurring in January 2015 (shortly after our main survey period), we were able to repeat the survey in the broader area surrounding the Sampson Flat fire scar (e.g. to include nearby suburbs and townships where residents may have been impacted by road closures), not only in the fire scar area itself. The questionnaire was sent to different households at 3 months, 6 months, and 12 months post-fire to explore whether perceptions changed at various time periods after a major bushfire. Households known to State Government authorities (DCSI and DEWNR) as having been severely affected by the fire were excluded from the list of potential participants so that they did not have to revisit the trauma.

The follow-up survey distribution elicited a return of 219 responses that were complete and usable. Combined with 100 surveys completed before the Sampson Flat Fire in this part of the AMLR, this produced an overall sample size of 319 for analysis.

- There were very few significant differences found between residents' perceptions of risk and perceptions of management before and after the bushfire.
- For rural residents (as opposed to those living in more urban locales), the mean rating of the current management of bushfire risk was higher in the 3 to 12 months after the bushfire than it was before the bushfire (4.4 compared with 4.0, where 1 = extremely poor and 7 = extremely good).
- Both before and after the bushfire, rural residents appeared on average to have very high levels of awareness of risk (significantly higher than those of urban residents). A large majority (both before and after the fire) already had a Bushfire Survival Plan. They also rated themselves as more knowledgeable about bushfire than their urban counterparts. The lack of significant differences (other than ratings of risk management) in rural residents' perceptions, actions and behaviours before and after the fire may in part be explained by this existing engagement they have with the bushfire dialogue. They are already aware of the risk and have an understanding of related issues and behaviours to undertake. Hence their recent exposure to a bushfire event has not had a substantial impact on them and has not altered their perceptions.





Climate Change

Examining an action gap and risk perception threshold [7]

The complex relationships between perceptions of climate change and bushfire risk, environmental value and support for actions to mitigate risk are presented for South Australia. Responses to a large survey of peri-urban residents suggest that a sceptical group of people are not recognising the link between climate change and bushfire risk, yet are nevertheless supportive of dramatic management interventions to reduce bushfire risk with prescribed burns and clearance of native vegetation. A larger group who are recognising the heightened risks of bushfires due to climate change are still more likely to value natural habitat, but some of that group are not developing or activating bushfire prevention plans.

Unless targeted communication strategies assist people to recognise the need for balanced management both to mitigate bushfire risk and conserve biodiversity, thresholds of risk perceptions may be exceeded that in turn lead to hazard mitigation policies that discount environmental values.

- 63.5% of respondents agreed that climate change was altering bushfire risk on their properties, with respondents from the LEP slightly more likely to do so than people in the AMLR.
- LEP respondents were more likely to agree that a bushfire was expected within the area within 1, 5, 10 or 30 years, but did not consider that their properties were more vulnerable (compared with AMLR respondents). This may be related to the fact that the LEP is generally more rural, and people who use their land for rural living or agriculture were more likely than those in urban areas to perceive an increased bushfire risk due to climate change and alter their Bushfire Survival Plans (BSPs) accordingly.
- While respondents who recognised climate change as a real risk to their region were more likely to perceive that a bushfire was likely in the next 10 and 30 years, there was no significant relationship between recognition of the risk of climate change and the perceived likelihood of bushfire within shorter timeframes (1 or 5 years).
- There is a direct relationship between perceived vulnerability to bushfire due to climate change and the updating of BSPs. Although most relationships between the development of a BSP and specific preparedness actions are quite weak, the step of generating a plan correlates with a greater likelihood of people undertaking preparatory actions.
- Those people with higher percentages of native vegetation on their properties were more likely to recognise climate change as a general risk, and were responding by updating their BSPs.
- Those people who perceive that climate change was altering the bushfire risk were *more* likely to thin vegetation and to prune large trees, but *less* likely to remove large trees from within 20m or 40m around their house. At the same time, those respondents who recognised the general risk of climate change were *more* likely to state that vegetation management should focus on removing non-native species and maximising biodiversity.

- Three groups were distinguished:
    - 38.4% recognise an increased bushfire risk in response to climate change and have changed their BSPs in response (Action Group 1) → rural; mid-age; more likely to have experienced bushfire damage; more likely to have native or wildlife gardens on their property; have strong ties to place; more actively preparing for the emerging risk; pro-environment;
    - 26.5% recognise an increased bushfire risk due to climate change but have not altered their BSPs (Action Gap Group 2) → 18-44 years; graduate education; living on residential size blocks; and,
    - 35.1% do not recognise that climate change alters bushfire risk (Sceptical Group 3) → older; male; may not believe in climate change; non-professional; lower levels of education.
- An initial conclusion is that people who recognise climate change and its influence over bushfire risk are less likely to support vegetation management that undermines local ecological values. They may be intervening to reduce the bushfire risk on their properties in a range of different ways, but importantly, not in ways that strongly diminish habitat values, such as via the more dramatic intervention of clearing large trees.
- Organisations that manage vegetation in peri-urban regions are coming under pressure to alter practices to ensure bushfire risk is minimised, while balancing other issues. At present, the people in peri-urban SA who recognise climate change as a driver of bushfire risk, also appreciate local ecological values. In contrast, the people who are most critical of contemporary vegetation management are less likely to consider that climate change is a problem. Together these findings suggest that a threshold of risk perception in relation to climate change and bushfire management has not yet been exceeded. Almost two-thirds of respondents already support a range of management outcomes that aim to strike a balance between bushfire risk mitigation and biodiversity conservation.





Exploration of climate change, bushfire, environmental values and associated behaviours [8]

Tegan Underwood, Honours project

This thesis used surveys to collect quantitative and qualitative data about residents living in the AMLR in terms of their climate change beliefs, bushfire experience and environmental values. The data collected were analysed to see if a relationship existed between bushfire preparedness and climate change mitigation. The study draws upon the New Ecological Paradigm (NEP) framework as a measure of ecological worldviews, finding that the majority of surveyed residents held moderately positive ecological worldviews. The main findings of this study were that knowledge and beliefs about climate change did not translate into mitigation behaviour. It was found that environmental values, in terms of ecological worldviews and place attachment, were a better predictor of residents' behaviour with respect to climate change mitigation, than were knowledge or beliefs about climate change. Another strong driver associated with climate change mitigation behaviours was direct experience with bushfire. The most influential driver of bushfire preparedness was high levels of knowledge about bushfire management. It was also found that there was a significant relationship between knowledge of bushfire management and the level of knowledge AMLR residents have regarding climate change.

- The majority of respondents believed climate change was occurring both on a global and local scale, but there was a distinct gap between knowledge and belief and behaviour. Climate change knowledge and beliefs were not drivers of climate change behaviours.
- Climate change mitigation behaviours were influenced by experience with bushfire and were also heavily related to environmental values in terms of place attachment and ecological worldviews. Environmental values are often deeply instilled within people and heavily influence our belief systems. Establishing links to behaviour is the first step in being able to change behaviour among residents. By pin-pointing the influential factors driving behaviour, educational strategies can target these factors so as to influence residents and their behaviour.
- Residents who had experienced a bushfire close to their neighbourhood or had their home damaged or destroyed in a fire were more likely to carry out climate change mitigation behaviours more frequently.
- Even though place attachment was high among residents, it did not translate to bushfire preparedness. An explanation for this could be the suggested barriers such as cost and being time poor outweighing the respondents' inclination to be more bushfire prepared. It could also be that people's attachment to a densely-vegetated area outweighs their concern for bushfire preparation. This reflects on educational strategies to inform residents on how they can maintain vegetation in a way that is fire smart.
- Direct experience with, and high levels of knowledge of bushfire management were directly associated with high levels of bushfire preparedness. Knowledge and experience were seen to be drivers of preparedness behaviour, and lower levels of knowledge of bushfire management translated to residents not being as prepared as they would like to be (for the bushfire season).

Preparedness and Readiness

Individual and community readiness on the LEP [9]

Housing developments on the urban fringe of many Australian towns and cities create complexities for bushfire management due to the network of natural, rural and urban subspaces that exist in these areas. To address the inherent risk of bushfire, local and state-wide policies and practices promote and encourage landowner responsibility for bushfire mitigation actions and behaviours. Our research suggests that despite advances in individual landholder preparedness for bushfires, overall community readiness appears to be lagging behind and needs more attention. The creation of fire-smart communities relies not only on engaged individuals but also a pervasive sense of shared ownership of the challenge of living in a high-risk bushfire zone.

- Discussions of emotional preparedness appeared to fall on a spectrum from feeling assured to feeling vulnerable.
- Feelings of assuredness seemed to come from engaging in physical preparations to reduce bushfire risk, being organised in bushfire planning, and staying vigilant during the bushfire season:

  My plan is I prepare my property the best I can. All through summer, winter and autumn I will spray and mow extensively. There's no growth around my place at all!
- There was a strong perception of being able to manage their land and reduce the risk that they face. Interviewees talked about the many ways they could reduce risk through vegetation management and landscaping. While they recognised that risk still existed despite these proactive actions, they felt the actions were important in creating safer places to live:

  You're never going to be able to be a hundred percent [certain] that the fire's not going to go through, but we believe we've done the best that we can.
- Vulnerability among participants seemed to arise from an almost nagging feeling that they could do more physical preparation on their own properties or their neighbours should do more.
- In addition, feelings of vulnerability emerged among participants who had not been personally engaged in physical preparation or who are dependent on other family members in responding to bushfires.
- Similarly, some participants described disparate physical abilities to prepare for bushfire among household members:

  My husband would do more of the preparation than me because he's retired and I'm not … and he'll actually [get the water pump out], because it's heavy and he's stronger and he's about 3 feet taller!
- Fire and environmental authorities also identified the vulnerability of residents who may think they are well-prepared but are in fact not, or those may indeed be physically well-prepared without realising the need to also be emotionally prepared.
- High levels of trust in the fire authorities and high levels of place attachment were evident among survey and interview participants. The presence of bushfire risk was generally known and accepted.

- Individuals who had something specific to do on their property to mitigate the risk, such as thin vegetation, mow lawns and prune or remove trees, appeared to feel more empowered and prepared. In contrast, individuals with little vegetation on their property, perhaps living on smaller blocks but still in medium and high fire-risk areas, and those who are less physically or mentally able to undertake mitigation activities themselves, appeared to feel (and be) less bushfire ready.
- Specifically, it is concerning that those living on smaller properties are significantly less likely to prepare a Bushfire Survival Plan or regularly update household members on their Plan, as many of these residents are living in medium and high bushfire risk areas. Similarly, it is concerning that they are less likely to prepare fire-fighting kits and protective clothing, or obtain battery-powered radios, all of which are tools to assist residents when threatened by a bushfire and may be important regardless of the size of their property.

Perceptions and preparedness of peri-urban residents on the LEP [10]

Jacob Arnold, Honours project

This thesis uses semi-structured interviews with 20 residents of the peri-urban fringe of the LEP to identify landowner perceptions and self-reported behaviours in relation to bushfire preparedness and vegetation management. The study draws on a modified version of the Theory of Planned Behaviour to understand key factors that motivate risk mitigation behaviours, including those that might impact biodiversity. Previous experience due to recent active fire history of the area resulted in many respondents expressing a high awareness of bushfire risk, and a high perception of control. Subjective norms were found to be important, with community interactions and bonding within the community over this issue perceived to be high. The study also examined the perceived value of educational products and programs distributed by authorities. It was found that education programs were effective in educating residents on the bushfire risk; however, negative trust relationships with state government agencies and low exposure to education on biodiversity meant the level of understanding about the relationship between bushfire and biodiversity management was less than desirable. Recommendations to improve bushfire safety in the peri-urban area, without compromising biodiversity, are presented.





Bushfire culture: Living with bushfire risk in the Adelaide and Mount Lofty Ranges [11]

Riki Owens-Bennett, Honours project

This thesis explores residents' intentions and expected behaviours in order to assist firefighting authorities and local councils in supporting residents in their bushfire preparation. Residents in the Blackwood Hills area completed an online survey investigating five key elements pertaining to bushfire preparedness: bushfire knowledge, level of preparedness, biodiversity values, information provision, and perceived barriers. Factors both facilitating and inhibiting residents' bushfire preparation were also investigated. Residents possessed a moderate level of bushfire knowledge and what was expected of them to prepare their home and properties each year. Despite residents' intentions to complete these activities, factors such as time, financial, and physical limitations were cited as barriers preventing completion before the bushfire season commenced. Additionally, while the level of awareness of CFS materials available to them was high and used by many, awareness and use of other support options were low. Concerns regarding the amount of information were raised by residents, indicating an over-saturation of detail and a desire for simplified materials identifying key actions.

Current preparedness efforts largely rely on the impetus from those outside the community rather than the residents using their own initiative and energy. Whilst a shift has occurred towards residents taking responsibility for their bushfire preparation and consequent evacuation from the area if needed, authorities are still expected to instigate reminders and motivate residents to take responsibility for their own protection. Involvement from authorities such as the CFS and local council remain important. However, the choice to live in an area at high risk of bushfire also requires a greater commitment on their own part to bushfire preparation. A series of specific recommendations have been made to further improve raising awareness and provide assistance to residents in their bushfire preparation.

Socio-ecological research

A landscape approach to management of bushfire risk in Greece and Australia [12]

Additional funding was provided by the Hawke EU Centre, the University of South Australia

With a focus on communities living on the urban fringe of the cities of Athens (Greece) and Adelaide (South Australia), we examined the interplay of managing to reduce the risk of bushfire and the protection of natural and cultural assets. Drawing on a policy analysis, secondary data and interviews with fire authorities, the similarities and differences in landscape and management were examined. The discussion proposes the value in a management approach that acknowledges the interactions between places and values, nature and people, and the past and the present. It was concluded that such approaches may offer innovation in re-framing the issues faced when managing for both fire risk and landscape conservation, enabling new types of synergies to take place in policy and planning.

Systematic review of fifteen years of research [13]

Our objective was to review recent social research that explores public and practitioner perceptions of risk mitigation and biodiversity values in relation to bushfire management. To do this we undertook a systematic review of bushfire management literature published over a 15-year period from the year 2000 to 2014 to evaluate the current state of knowledge addressing public and practitioner perceptions of the relationship between bushfire risk and biodiversity conservation within a fire management context. A total of 39 articles addressed this issue, suggesting a disconnect between research into perceptions of bushfire risk mitigation and perceptions of biodiversity conservation. An integrated research approach that addresses the social component of the impact of risk mitigation policy and biodiversity conservation strategies is needed.

- While the field of socio-ecological research has developed considerably in the last 20 years, the application of this socio-ecological approach to bushfire research is still very limited.
- The delayed uptake of fire research to acknowledge socio-ecological complexity may be due in part to the extreme nature of the hazard, which can act to polarise interest in the topic. It may also be that because there is still so much to learn about fire ecology, weather, risk, fuel, fire behaviour, and management, that research priority is given to these research areas. Indeed, many fire studies do acknowledge the complexity of the fire management problem, but not explicitly in terms of biodiversity which is one of several important complexities.
- The review reinforces that agency–community engagement is both desirable and beneficial in the field of fire management if policy is to be about solving problems associated with behaviours in conflict with long-term public good. Examples of Australian programs working in this field include the South-East Queensland Fire and Biodiversity Consortium (www.fireandbiodiversity.org.au), the New South Wales Hotspots Project (www.hotspotsfireproject.org.au), and the Tasmanian Red Hot Tips program (www.sfmc.tas.gov.au/red-hot-tips).
- The aim should be to help generate better-informed policy rather than simply providing an input to a linear policy process whereby communities are studied and outcomes are fed into the policy process undertaken by government agencies.
- Understanding the diversity of values that exist—biodiversity values being but one of those values—and the ways that stakeholders may place conflicting demands on current fire management practices will not only better inform policy, but can also help managers make better informed assessments of how different segments of the public may respond to specific policies and policy changes.
- The review furthers our understanding of the current state of knowledge and articulates the knowledge gap concerning perceptions of biodiversity conservation in a fire management context. This is important because access to information can be a major barrier inhibiting a greater alignment between research and policy.

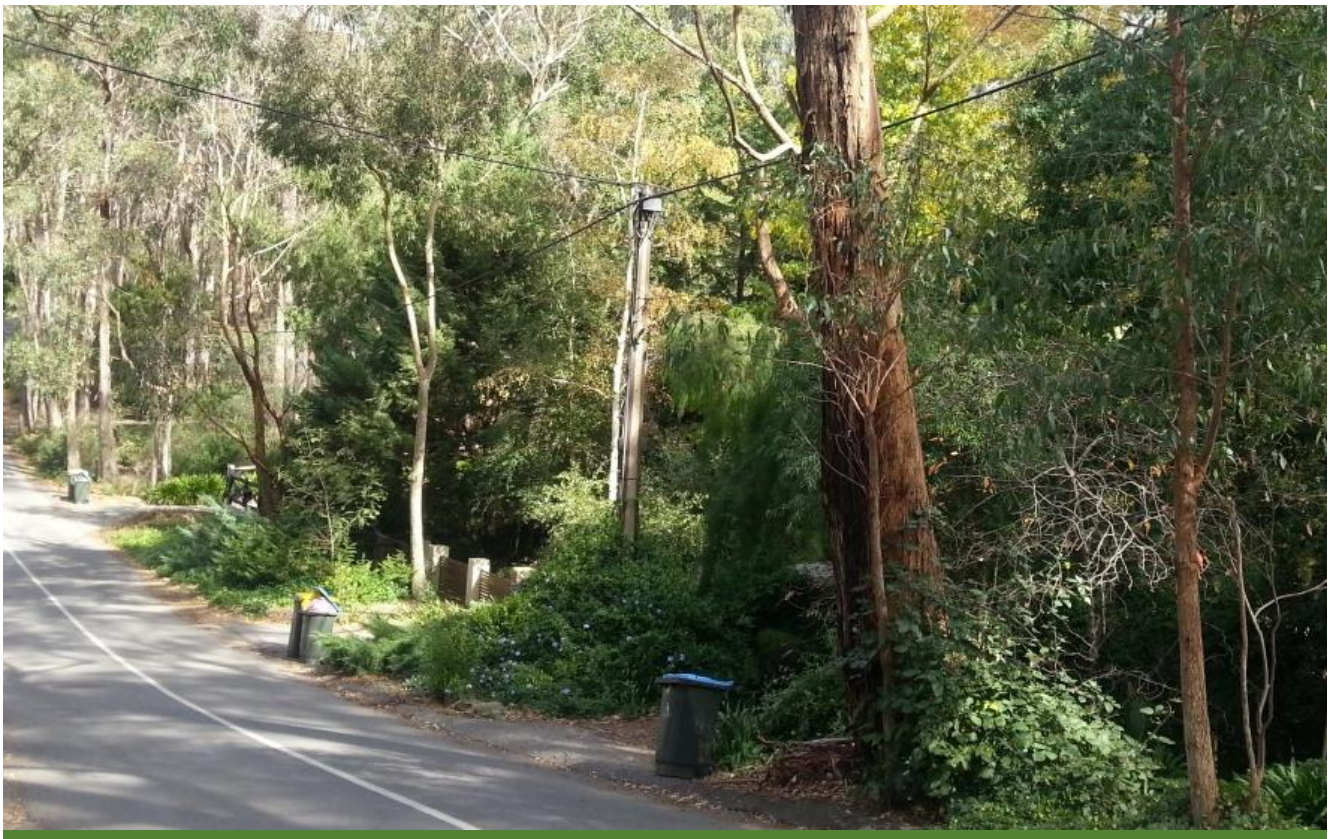
Adelaide's peri-urban development

Residential development in the peri-urban fringe: The example of Adelaide, South Australia [14]

The peri-urban fringes of large metropolitan areas of Australia continue to experience major changes as natural and semi-natural landscapes are converted to built-up areas largely through increased residential development. These irreversible conversions are producing significant challenges for ecological and environmental protection. Yet, there has been little attempt to systematically analyse and model some of the key spatial features of these peri-urban fringes, especially in terms of examining factors underpinning new residential development. This paper attempts to fill this information gap using Adelaide, South Australia, as an exploratory case study. Using parcel-level data, we quantified spatial patterns of residential development during four consecutive periods (ten-year intervals between 1971 and 2010), revealing a gradual slow-down in the rate of new housing development after the 1980s. The effects of major roads and services, residents' attraction to areas of high natural amenity, and previous residential development were estimated using logistic regression models and geographically weighted logistic regression models, respectively. Variation partitioning was used to examine the relative importance of three groups of predictors of residential development. Roads and services had the greatest impact on the pattern of residential development in the 1970s, while previous residential development ranked first among the three groups of forces in the last three time-periods. Influences relating to the attraction of natural amenities were of the least importance to peri-urban residential development during all four periods. These findings can help understand change mechanisms within peri-urban fringes and to develop corresponding policy responses to improve their management.

Greening and "un"greening Adelaide, South Australia [15]

The original design for Adelaide incorporated a green belt (known as the Park Lands) around the city centre, itself laid out on a one square mile (2.59 km2) grid and including five large public squares. The Park Lands provided a barrier to urban sprawl and covered approximately 9.31 km^2, of which 1.53 km^2 has been used subsequently for cultural institutions, railways, cemeteries, sporting facilities and other constructions. In addressing issues of greening pertaining to Adelaide, the Park Lands and its management represents a core element in the evolving history of the city's growth. This paper considers some of the contradictions within this growth, examining the changing attitudes of government and the populace to the Park Lands, and also to the increasing sprawl of the city. It can be argued that this sprawl has been antithetical to maintenance of biodiversity and principles of "greening", not only during the main phase of expansion in the 1960s and 1970s but also in recent years when planned development on prime farmland and other "green" areas is contributing to problems for provision of transport infrastructure and generally reducing capacity for sustainability. The potential for conflict between the desire to maintain biodiversity versus protection for the growing number of people moving into bushfire risk areas is just one of several examples of problems arising as a result of a relaxed attitude to low-density expansion. In examining these problems, the paper presents maps of the changing footprint of Adelaide and elaborates new "greening" initiatives that include green roofs, new systems of water harvesting, community-supported agriculture and schemes directly aimed at creating low-carbon living. A consistent theme is the contradictions within plans for the city between greening and "un"greening.



Highlights & Final Thoughts

Highlights & Recommendations

Planning

- Current planning legislation does not sufficiently accommodate the growing risk of bushfire in relation to the placing and shaping of new urban/suburban developments.
- The pendulum of cultural interpretations of risk and value could swing widely in the future (e.g. driven by responses to climate change) to the detriment of environmental assets.
- A balanced approach to risk mitigation and biodiversity protection is possible but there are gaps in the current planning system that could undermine this.
- The planning system needs to attain a better balance between the influence of specialist planners, the community, major actors (e.g. business) and elected representatives.

Biodiversity values

- Residents are largely open to a sophisticated ecological debate regarding the challenges of maintaining biodiversity in the face of a growing risk of bushfires. The debate should consider all stakeholders and various priorities.
- There are clear differences between men and women in their ecological values, fire risk assessment, preparation and response. Current bushfire planning outreach insufficiently acknowledges these differences, emphasising physical rather than emotional preparedness.
- Cultural nuances of acknowledgement of risk and prioritisation of biodiversity values need to be integrated into management.

Climate change

- People who recognise climate change and its influence over bushfire risk are less likely to support vegetation management that undermines local ecological values.
- On the other hand, a group of sceptical residents who do not recognise the link between climate change and bushfire risk are supportive of direct management interventions to reduce bushfire risk with prescribed burns and clearance of native vegetation.
- Without targeted communication strategies to assist people to recognise the need for balanced management both to mitigate bushfire risk and conserve biodiversity, thresholds of risk perceptions may pass that in turn lead to hazard mitigation policies discounting environmental values.

Preparedness and readiness

- Despite advances in individual landholder preparedness for bushfires, overall community readiness appears to be lagging behind and needs more attention.
- The creation of fire-smart communities relies not only on engaged individuals but also a pervasive sense of shared ownership of the challenge of living in a high-risk bushfire zone.
- Preparedness efforts for bushfires largely rely on the impetus from those outside the community rather than the residents using their own initiative and energy. This restricts the impact of many attempts to better educate residents about bushfire risk and desirable actions to take.

Comments from Final Workshop

Key points from the final workshop held between the Research Team, Partner Investigators and other key stakeholders are presented below.

Planning considerations

- We need to transition from a fire response culture to a society that accepts there are risks but actively plans to reduce that risk by creating fire-smart landscapes. Individuals should be creating integrated fire management plans that include consideration of maintaining or enhancing biodiversity.
- We need to mobilise residents to invest time, effort and money into safety and planning for a fire event.
- Plans for future growth of Adelaide have paid insufficient attention to future conflict between safety of residents in the event of a bushfire and protection of both biodiversity and valuable landscapes. Moving away from an individual 'Bushfire Survival' focus to a 'Fire-Smart Landscape' focus would be advantageous.

It is essential to be able to influence planning. There need to be triggers for consultation earlier in the process. Fire management agencies need to have a strong voice in the early stages of new development proposals and their feedback needs to be perceived in the constructive way it is intended, rather than as obstructionist or 'blocking'. To be able to plan effectively, planners need access to appropriate information and the ability to make the 'right decision' without fear of ramifications.

Management considerations

- Overall, people are not supportive of widespread vegetation clearance to reduce the risk of bushfire. Only a minority of people are willing to discount biodiversity.
- There is still a high focus on 'trees' rather than fine fuel. There is a need to educate people and/or key decision makers to develop a more sophisticated understanding of ecology and fire behaviour.
- Attachment to place seems to drive good citizenship (e.g. suitable actions are more likely to be undertaken by residents who value the neighbourhood in which they live).
- It is useful to consider the community spatially as well as socio-culturally.
- There is an Action Gap Group of residents who need to be mobilised to act on the information they have.
- What will be the best return on investment for management? For some cohorts of the public it might be more suitable to focus resources on weed management for example, rather than trying to change all residents' behaviour.
- Knowledge gaps to address include:
    - Who are the people who think they have little influence over the management of bushfire risk and biodiversity conservation?

    - Residents appear generally open to the conversation but what level and type of information/education will help tip the balance to make them act more suitably with respect to both bushfire risk mitigation and biodiversity conservation?
    - Are residents' perceptions of weeds in the landscape accurate?
- More meaningful ways to engage partners need to be explored. For example, public fire walks following a bushfire could help raise awareness of weeds, native species and regeneration.
- It is essential to define exactly what the main message and sub-themes are when developing a communication strategy. It needs to be targeted to the particular audience and broken into a small number of simple steps if we are to elicit behavioural changes.



Research Team & Acknowledgements

Research Team

From the University of South Australia and The University of Adelaide, the team comprised Professor Guy Robinson (Chief Investigator), Dr Douglas Bardsley (Chief Investigator), Associate Professor Delene Weber (Chief Investigator), Dr Emily Moskwa (Postdoctoral Research Fellow) and the late Professor Graeme Hugo (Chief Investigator).

Focusing on select areas of the project were also Annette Bardsley (PhD Candidate, The University of Adelaide) and Jacob Arnold, Riki-Owens-Bennett and Tegan Underwood (Honours students, University of South Australia).

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Photo credits

Cover page: *Clockwise from top left (aerial image Adelaide Hills):* Campbelltown City Council; Emily Moskwa; Calvin Hoye; Emily Moskwa
Summary *i*: Dale Smith (www.photographybydale.com.au)
Summary iv: *(aftermath of Sampson Flat fire near Gumeracha)* Guy Robinson
Page 9: Calvin Hoye
Page 18: *left image (lost revegetation):* Sophie (Topa) Petit; *right image (habitat tree):* Di DeLaine
Page 21: *left image:* Di DeLaine; *right image:* Calvin Hoye
All others: Emily Moskwa



Publications

List of Publications

[1] Bardsley, D.K., Weber, D., Robinson, G.M., Moskwa, E., & Bardsley, A.M. (2015). Wildfire risk, biodiversity and peri-urban planning in the Mt Lofty Ranges, South Australia. *Applied Geography, 63*, 155–165.

[2] Moskwa, E.C., Bardsley, D.K., Robinson, G.M., & Weber, D. (under review). Generating narratives on bushfire risk and biodiversity values to inform environmental policy. *Environmental Science and Policy.*

[3a] Bardsley, A. (2017). Bushfires in South Australia: Who decides on the future plans for our suburbs? Presentation to the AHURI Symposium, Melbourne, 12-14 February.

[3b] Bardsley, A. (2016). Planning for landscape risk and value in peri-urban Adelaide. AHURI Symposium, Auckland, 14-16 February.

[3c] Bardsley, A. (2015). Demographic change and planning within peri-urban regions of Mediterranean Australia and France. AHURI Symposium, Hobart, 15-17 February.

[4] Moskwa, E.C., Bardsley, D.K., Weber, D., & Robinson, G.M. (under review). Living with bushfire: Recognising ecological sophistication to manage risk while retaining biodiversity values. *International Journal of Disaster Risk Reduction.*

[5] Davenport, M.A., Weber, D., Moskwa, E., Bardsley, D.K., & Robinson, G.M. (2016). Social vulnerability to bushfire in South Australian peri-urban communities. *International Symposium on Society and Resource Management*. Houghton, Michigan, June 22-26.

[6] Initial findings from the analysis undertaken with the post-Sampson Flat Fire follow-up survey data set. Research Paper under preparation.

[7] Bardsley, D.K., Moskwa, E., Weber, D., Robinson, G.M., Waschl, N., & Bardsley, A.M. (under review). Climate change, wildfire risk and biodiversity values: examining a risk perception threshold in peri-urban South Australia. *Society and Natural Resources.*

[8] Underwood, T.D. (2016). Exploration of climate change, bushfire, environmental values and associated behaviours: A study of residents living in the Adelaide and Mount Lofty Ranges (unpublished Honours thesis). University of South Australia, Adelaide, Australia.

[9] Moskwa, E., Weber, D., Davenport, M.A., Robinson, G.M., Bardsley, D.K., & Arnold, J. (submitted). Landowner preparedness and community readiness for bushfire on the Eyre Peninsula, South Australia. *International Journal of Wildland Fire.*

[10] Arnold, J.D. (2015). Bushfire risk and biodiversity management: Perceptions and preparedness of peri-urban residents on the Lower Eyre Peninsula (unpublished Honours thesis). University of South Australia, Adelaide, Australia.

[11] Owens-Bennett, R. (2016). Bushfire culture: Living with bushfire risk in the Adelaide and Mount Lofty Ranges (unpublished Honours thesis). University of South Australia, Adelaide, Australia.

[12] Moskwa, E.C., Robinson, G.M., Weber, D., & Bardsley, D.K. (under review). A landscape approach to management of wildfire risk in Greece and Australia. *International Journal of Environmental Studies*.

[13] Moskwa, E.C., Ahonen, I., Santala, V., Weber, D., Robinson, G.M., & Bardsley, D.K. (2016). Perceptions of bushfire risk mitigation and biodiversity conservation: A systematic review of fifteen years of research. *Environmental Reviews, 24*, 1–14.

[14] Liu, Z., & Robinson, G.M. (2016). Residential development in the peri-urban fringe: The example of Adelaide, South Australia. *Land Use Policy*, 57, 179–192.

[15] G.M. Robinson, & Liu, Z. (2015). Greening and “un”greening Adelaide, South Australia. *AIMS Environmental Science*, 2(3), 511–532.

In Preparation

- Living with bushfire: Recognising ecological sophistication to manage risk while retaining biodiversity values.
- Climate change, bushfire risk and environmental values: examining a risk perception threshold in peri-urban South Australia.
- Generating narratives on bushfire risk and biodiversity values to inform environmental policy.
- Landowner preparedness and community readiness for bushfire on the Eyre Peninsula, South Australia.
- Balancing management of bushfire risk and biodiversity conservation: Findings from the Sampson Flat Fire, South Australia.
- A landscape approach to management of wildfire risk in Greece and Australia.
- G.M. Robinson, 'Nature as threat and opportunity in the peri-urban fringe', In: Marsden, T.K. (ed), *The Sage Handbook of Nature*, Sage: Los Angeles, Ca. IN PRESS.